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WORKSHOP NOTE-BOOK

WOODWORKING

ARRANGED BY

GEORGE G. GREENE

THE MANUAL ARTS PRESS

PEORIA, ILLINOIS

Student's Name .....

Section ..... Bench Number .....

WORKSHOP NOTE-BOOK

WOODWORKING

ARRANGED BY

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Instructor in the Lane Technical High School

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USE OF THIS NOTE-BOOK.

The aim of this note-book is threefold:

1. To furnish a few general directions about tools and processes which the student in woodworking must know in order to become an intelligent and reliable workman.

2. To provide space where such additional notes may be written down as the teacher may indicate.

3. To provide space where the student may make working drawings of the exercises or articles which he is to construct.

It is to help the pupil remember what the teacher did and what he said.

A Suggestion to the Pupil.

It will save time to see that your tools are sharp, for not only will they cut faster, but the work will be neater and more accurately done.

Sharp tools will also save material, as dull tools tend to tear and split the wood.

It is not so much what you do as how you do it that counts.

Take for your trade mark M. V. B.—MY VERY BEST.

Rules of the Shop.

1. Do not leave your bench except to go to the grindstone or to procure some tool or material allowed by the teacher.

2. Only one pupil may use the grindstone at a time.

3. Do not sit or lie on your bench. It is a bad habit and produces a bad impression.

4. General talking or interfering with other pupils is strictly forbidden.

5. If you want to ask your teacher a question raise your hand, but do not leave your place unless he tells you to.

6. Pieces of wood that may be of any value should be put in the scrap box, or place reserved for such pieces.

7. Pupils must not start or stop motors or machinery without permission from the teacher.

8. Stop work when the signal is given and be ready to pass out in a quiet and orderly manner.

9. Never put oily waste or rags into a drawer. They are liable to catch fire.

10. If your bench is provided with a drawer keep it closed when at work, so that dust and shavings will not gather in it.

List of Tools.

Measuring and testing tools—

Rule
Try-square
T-bevel
Gage
Dividers
Winding sticks

Cutting tools—

Rip-saw
Cross-cut saw
Back-saw
Jack-plane
Smooth-plane
Block-plane
Knife
Spokeshave
Chisels
Bits

Miscellaneous tools—

Brace
Hammer
Mallet
Oilstone
Oil-can
Screwdriver
Nippers
Nail-set
Brush

Important: First—In the above list, underscore the names of all the tools with which you are provided. If you have any not printed in this list, write their names in the extra space.

Second—Notice whether the number stamped on each tool corresponds with that of the bench.

Third—If any tool is gone, make a check (X) opposite its name in the above list.

Fourth—If any tool is broken, make a check (B) opposite its name in the above list.

You are held responsible for your tools. Therefore, before starting work each day, always report to your teacher any tool either missing or broken.

An apron or overalls will save your clothes and make you feel more like a workman.

Call each tool by its proper name and notice how the name is spelled.

Always put away tools in their proper places, and keep your drawer or locker clean and in order.

THE RULE.

Purpose: To measure distances.

Directions for use: To lay off dimensions accurately the marks on the rule should be brought as close as possible to the surface on which the marks are made.

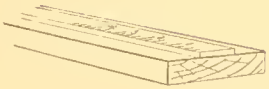


Fig. 1

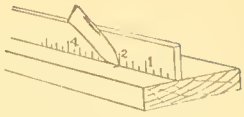


Fig. 2

The common way of using the rule, as in Fig. 1, will not do for fine work. The careful workman always sets his rule on the edge as in Fig. 2 and uses a sharp knife or fine-pointed lead pencil to make a mark. If you guess at distances, you will only waste time and material.

Important: After laying out a piece of work always have it inspected by your instructor before making a cut, as it is easier to correct a mistake in the beginning than after much time and labor have been expended.

THE TRY-SQUARE.

Purpose: To draw lines at right angles to an edge. Also to tell whether two adjacent surfaces are square with each other.

Directions for use:

1. See that the handle or beam is tight against the edge of the board before testing for squareness or laying off a line.

2. All lines across the grain should be made with the square, using a sharp-pointed knife. This is called scribing.

3. Use a lead pencil for rough work or when laying out a chamfer.

Scribing looks easy, but a beginner is very apt to let his square or knife slip. It will pay to practice on a waste piece before squaring up your first exercise.

A good test of your skill is to start at one edge of a board whose sides and edges are parallel, and square clear around it. If you do not finish exactly where you started from, try it again.

THE GAGE.

Purpose: To make lines parallel with the edge of a board.

Directions for Use: Always see that the point is sharp like a knife and parallel with the sliding head. Fig. 3. It should not project more than 1/16 of an inch.

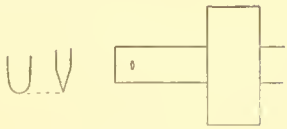


Fig. 3

2. Set the gage with your rule because the scale on the gage is seldom accurate.

3. Gage away from yourself, dragging the point lightly through the wood.

4. Never gage across the grain, as the point tears the fibers, producing a ragged line.

5. Practice until you can gage by the sense of touch.

Caution: If the head it not held firmly against the edge of the board, the gage line will not be accurate.

The gage may be forced away from the edge of the board if the point is not parallel to the head, or if the grain of the wood runs towards the edge from which you are gaging, or if your hand does not grasp the gage as near the point as possible.

THE SAW.

Three kinds: Rip-saw, Cross-cut saw, and Back-saw.

Rip-saw teeth are filed straight across, making chisel-like points or edges. Fig. 4.

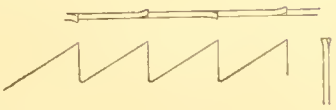


Fig. 4

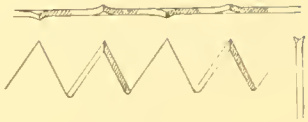


Fig. 5.

Cross-cut saw teeth are filed on a slant from alternate sides, making sharp points like knife points. Fig. 5.

The back-saw is a thin saw with fine teeth, filed like a cross-cut saw. It has a heavy strip on the back to stiffen it.

The set of a saw is the spread given to the teeth sidewise to allow the saw to pass more easily through the saw cut, or kerf, as it is called.

The number on a saw shows how many teeth there are to the inch.

A rip-saw is not always numbered when the number of teeth to the inch is 8, nor the cross-cut saw when the number is 10.

In making a cut, first be sure that you have the right saw. Then take long, steady strokes, paying attention to three things:

1. Start, not on the line, but on the side of it that is not going to be used. This gives a chance for the rough end to be smoothed or finished down to the line.

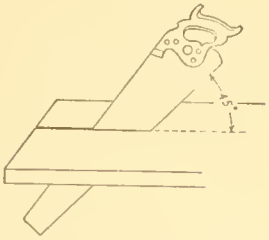


Fig. 6

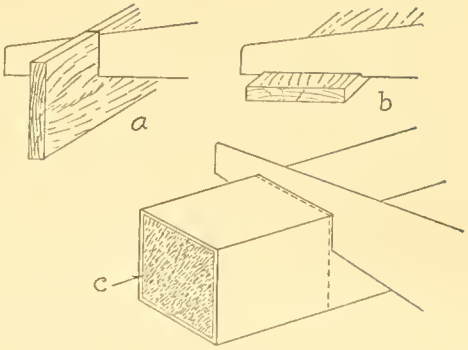


Fig. 7

2. Gradually follow beside the line as closely as you can without cutting it.

3. Do not let the saw lean over, but keep it perpendicular to the board by testing it frequently with a square.

4. A line squared across two adjoining faces will be a great help in keeping the saw perpendicular to the piece of wood, as in Fig. 7.

When ripping hold the saw slanting about 45 degrees with the board, as it will then work easier and cleaner. Fig. 6.

When using a cross-cut or back-saw, smoother work is produced by cutting across the face of a board rather than across the edge. Fig. 7b. Why?

Lift the saw up slightly rather than press down, when the strokes are taken.

Only by much practice can one become skillful with the saw.

A skilled workman will saw so close to a knife line that it will be exposed all the way around as in Fig. 7c.

THE CHISEL.

This is a paring tool and should always be kept keen and sharp, with a bevel about ⅜ or ½ inch long. Too thin an angle leaves an edge which is easily dulled in cutting hard wood.

After the chisel has been used a long time it becomes rounded as in Fig. 8, and must then be ground. To do this, stand

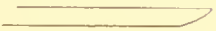


Fig. 8

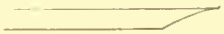


Fig. 9

so that the grindstone will turn away from you. This is slower than if the grindstone turned toward you, but is much safer and causes less wetting from the water which is used on the stone. It is important to hold the chisel square and steady until a feather edge appears. Fig. 9. This must be removed on an oilstone by careful whetting, first on one side, then on the other. Fig. 10.

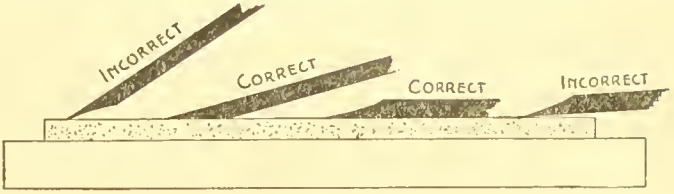


Fig. 10

Caution: When whetting the flat side, keep the chisel perfectly flat, as even a slight bevel makes paring a much more difficult operation.

When grinding a hardened steel tool always see that there is plenty of water on the stone, for two reasons:

1. Because without water the stone soon becomes glazed or coated with fine particles of steel, which have to be removed before the stone will cut.

2. To keep the tool from being heated, thus losing its temper.

A blue color near the edge of the tool shows that the steel has become softened by heat, and will not keep its edge.

These directions apply in sharpening a plane blade as well as a chisel.

Chisels should not be hit with a hammer. Always use a wooden or rubber mallet. Why?

Planes in common use are:

Block-plane	6	to	8	inches long.
Smooth-plane	8	to	10	inches long.
Jack-plane	12	to	15	inches long.
Fore-plane	15	to	20	inches long.
Jointer	24	to	30	inches long.

A plane which is used for rough work, has its blade sharpened as in Fig. 11, while for smooth work only the corners are rounded as in Fig. 12.

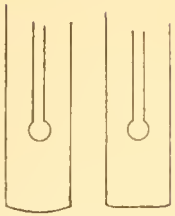


Fig. 11 Fig. 12

Fig. 13

The cap-iron is set about 1-32nd of an inch from the edge of the plane-blade and helps to make smoother work by breaking the shavings, as shown in Fig. 13. When planing cross-grained wood, set the cap-iron as close to the edge of the blade as possible.

Important: When putting the plane together see that both adjusting levers are in place before tightening the clamp, Fig. 14.

When the plane becomes choked always take it apart. Never use a knife or other instrument to remove the obstruction.

Four Adjustments of the Plane:—1. The vertical adjustment, controlled by the thumb-screw. It sets the blade in or out according to the thickness of shaving desired.

2. The lateral or side adjustment, controlled by the shifting lever, which throws the blade to either side.

3. The frog adjustment, controlled by the screw behind the frog, which opens or closes the mouth of the plane to regulate the size of the shaving for planing straight or cross-grained wood. For which do you wish a larger opening?

4. The cap-iron adjustment, by reason of which stiff shavings are broken, thus allowing the plane to cut against as well as with the grain.

In starting to plane, more pressure should be put upon the toe, but as you proceed shift the pressure from toe to heel, as illustrated in Fig. 15.

A good workman always tries to make long, fine shavings. Short, thick shavings indicate thoughtless, careless work.

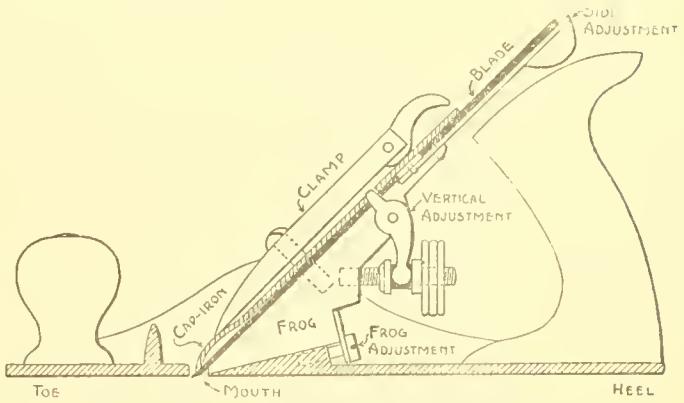


Fig. 14

Important:—Examine and test your work often.

Practice planing till you can get a smooth and perfect surface. Any irregularity in the surface is due to one or more of the following causes:

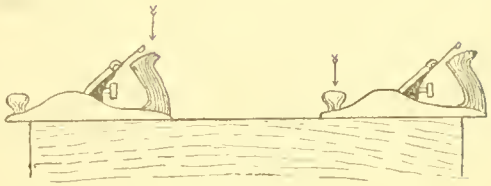


Fig. 15

1. The blade may be ground straight across and set out too far. Fig. 16, A.

2. The blade may project too far on the right or on the left side. Fig. 16, B.

3. The blade may be ground with too much curve. Fig. 16, C.

4. Small grooves may be produced by chips in the plane or by the edges or ends of the bottom of the plane becoming battered. Fig. 16, D. Remove such small projections with a file.

5. There may be nicks in the blade. Fig. 16, E.

6 There may be chatter marks caused by a dull blade or by holding the plane or the work in a weak manner.

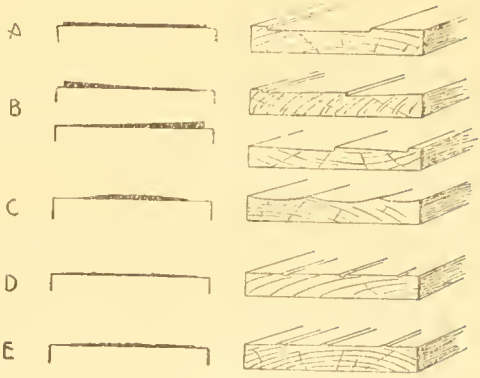


Fig. 16

The terms used in referring to the parts of a board are the face, edge and end; length, width and thickness. Fig. 17.

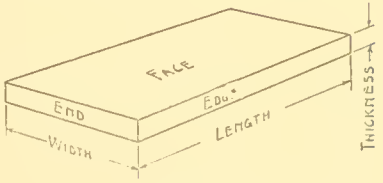


Fig. 17

Directions for Planing a Board to Given Dimensions:—

1. Plane a face smooth and true and mark it 1.

2. Plane an edge square with 1 and mark it 2. This is called a working or face edge.

3. Plane an end square with 1 and 2, and mark it 3.

4. Measure length and square around, using knife lines. Plane down to the line.

5. Gage width and plane down to gage line.

6. Gage thickness and plane down to gage line.

Planing with the grain is easy. The trouble is that most boys plane under the line before they notice it. When near the line always look at it before each stroke.

Planing across the end is much more difficult, for, if a shaving is taken off clear across the end, it is sure to make one or more splinters down the further edge. Fig. 18.

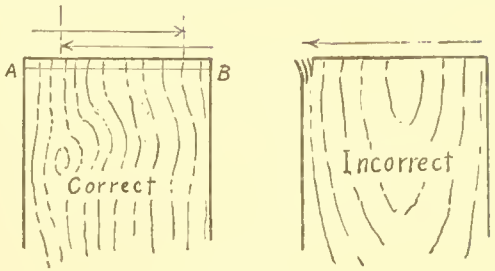


Fig. 18

The best way is to mark a line, AB, with a square, and knife clear around the end of the piece. This cut helps to keep splinters from forming and also shows when all the waste wood has been removed.

The plane should go part way across a few times from one direction, and then a few times from the other, until the knife line shows all the way around.

This operation cannot be done unless the plane is sharp and set fine.

BORING TOOLS.

These include auger bits, gimlet bits, Forstner bits, twist drills, or drill bits, extension bits, and countersinks.

The size of a bit is determined by a number stamped on the shank, also by measuring the distance across the bit from nib to nib.

Fig. 19

Auger bits vary in size by 16th of an inch, beginning with 3-16th. Only the numerator is used to indicate the size; for example, 10 stamped on a bit means that the size of the bit is 10-16ths or 5-8ths inch.

Gimlets and drill bits vary by 32nds of an inch. Metal drills vary by 64ths of an inch.

Bits are sharpened only on the inside of the nibs, and on the sides of the lips away from the spur. Fig. 19.

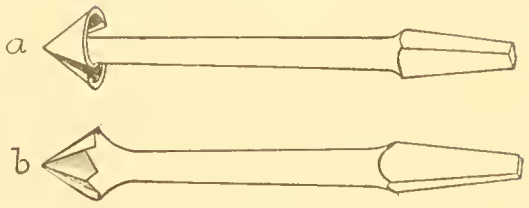


Fig. 20

Forstner bits should be used with great care, for when dulled they are very difficult to sharpen.

A bit gage is an instrument which, when fastened to a bit, allows it to bore only to a certain depth.

The countersink is used to enlarge a hole which is to receive a flat-head screw. This allows the head to fit down closely into the wood. This tool is made in several different shapes.

A double-lip countersink, Fig. 20a, is only used for wood.

A rose countersink, Fig. 20b, and may be used for iron as well as wood.

GLUE.

Glue may be obtained in two forms, viz.: the liquid and the dry.

The former is ready for use when cold, but the latter must be dissolved in hot water and used hot enough to flow easily. A thick, luke-warm glue is worse than none. To make a good joint warm the wood before applying the glue, as the strength of the joint depends on the depth to which the glue penetrates the surface. For this reason never try to glue up a piece of wet lumber.

Caution: See that the clamps to be used are properly adjusted, and that all parts fit together perfectly before applying the glue. If wooden hand-screws are to be used care must be taken to keep the jaws parallel. Otherwise the work will not be held in close contact, and there will be danger of bending and breaking the screws. Fig 21 shows the wrong way to do it.

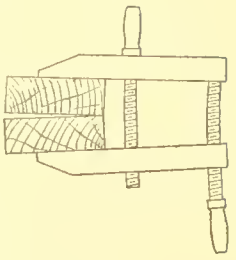


Fig. 21

SANDPAPER.

Sandpaper is not usually considered one of the shop tools, but it is necessary that just as much attention should be given to its proper use.

It is not intended to take the place of a cutting tool, but many boys try to do with sandpaper what should be done with a chisel or a plane, and the result is very unsatisfactory work.

The sand used in making sandpaper is crushed quartz, a good abrasive, on account of its sharp edges. This is graded according to size of particles, from the finest No. 00 to No. 3, the coarsest.

Do as much finishing as possible with your chisel or plane. Then sandpaper last of all. Why?

Always sandpaper with (along) the grain. Why?

In sandpapering flat surfaces always stretch the sandpaper over a soft pine block, thus preventing the corners from being rounded.

Any one can round a corner, but it is a skilled workman who keeps the edges of his work clean-cut and accurate.

You may cut sandpaper with old shears or a knife or tear it by holding it against the edge of a board or a piece of iron.

NAILS.

Nails were first forged by hand. Later they were cut from sheet steel and headed by machinery. Now they are made from steel wire by a machine that points and heads them with great rapidity.

The different kinds are common nails, finishing nails, casing nails and brads.

Formerly the size of nails was specified by the number of pounds that one thousand would weigh. Gradually the word pound was changed to penny; for example, 6d, or 6 penny, nails means that one thousand of that size weigh 6 pounds. Six penny nails are two inches long; 10d nails are 3 inches long.

Common nails have large heads and are used for rough work.

Brads and finishing nails are used for fine work; therefore their heads are small so that they may be set down in the wood with a nail set and easily concealed with putty.

In hard wood it is almost impossible to drive a brad or finishing nail without first making a small hole with a drill or awl.

SCREWS.

There are several varieties of screws.

How many different kinds can you name?

Their size is described by their length in inches, and the gage or size of wire from which they are made.

For example: What does this statement mean: 1-inch, No. 10, flat-head, bright?

Screws may be driven into soft wood without first boring a small hole, but they are liable to go in a wrong direction and the head is often damaged and even split off.

Fig. 22

When joining two pieces of wood together by means of screws, as in Fig. 22, the upper board should have a hole in it large enough to let the screw slip through easily. The lower board should have a hole bored in it smaller than the screw in order to let the thread catch. This is sometimes called the pilot hole.

How can you tell what size each hole should be? Never try to force a flat-head screw so that the head is flush with the surface, but use a countersink, Fig. 20, to make a place for the head.

Both nails and screws will drive much easier in hard wood if they are coated with a little soap or grease.

Caution: Small slim screws especially those made of brass are easily broken, and it is much better to back out a tight screw and enlarge the pilot hole than to have it break off just before it is well in place. Also see that you use a screwdriver whose point is the right size and shape to fit in the screw. If your screwdriver has a shape that is incorrect, Fig. 23, see that it is properly ground before being used.

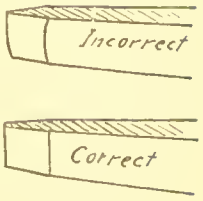


Fig. 23

FINISHING.

Wood is finished for two reasons:

1. To bring out the grain or beautiful figures in the wood.
2. To make it wear better, and to preserve it from the weather.

Articles for outdoor use must receive several coats of paint or spar varnish. Common varnish or shellac will turn white when wet.

Furniture and articles protected from the weather receive different treatments, depending on the structure of the wood (open or close-grained), and the use to which they are put.

The first essential to good finishing is a hard smooth surface. The pores of open-grained wood such as oak or mahogany must first be closed with a filler made of whiting, linseed oil and turpentine, with the addition of some coloring matter, such as burnt umber, if a stained effect is desired.

As soon as the filler sets, say in about 20 minutes, it is rubbed thoroughly with a cloth or piece of waste to remove the excess filler and to bring out the grain. If there are any fibres projecting they should be removed with fine (No. 00) sandpaper.

Birch and maple, being close-grained woods, need no filler, but are usually stained with some dye, such as logwood.

If a dull finish is desired give the wood a coating of prepared wax. Let it stand about an hour, and then rub vigorously with a soft cloth or felt pad This is not a durable finish, but it can be easily renewed.

A hard glossy finish is made by applying two or three coats of shellac or clear copal varnish. When dry, rub each coat with worn or fine sandpaper,.

Caution: Hold the sandpaper lightly in the hand so that the stain or varnish will not be removed from the edges or high places. If a dull finish is desired, rub the final coat with a paste made of pulverized pumice stone, or rotten stone, and linseed oil, or water.

Important: Shellac does not dry in thirty minutes; it only sets. It should dry for six or eight hours before being rubbed or sanded.

Varnish requires at least two days to dry hard enough to be rubbed.

Varnish is thinned with turpentine, and shellac is thinned with alcohol.

Because alcohol evaporates very rapidly shellac must be put on quickly with as few strokes as possible.

Two or three thin coats are better than one that is thick and sticky.

WOOD.

Wood is the cheapest, the most easily obtained and the most easily worked of all materials available for the use of man. According to government reports the consumption of wood in this country averages 125 cu. ft. per capita; Germany uses only 37, and France but 25 cu. ft. per inhabitant.

About a cubic half mile of timber is cut annually in this country, but fortunately so many things are now being made of steel and concrete that the rapid destruction of our forests is lessening.

That we may be more careful not to waste wood, let us remember that 25% of each tree, consisting of tops and branches, is left in the forest, and 35% is left in the saw mill in the shape of slabs, saw-dust and shavings. A further waste of 7 or 8% is suffered in the process of getting the lumber out of the forest. With the decay of houses, posts and railroad ties, and the destruction of boxes and barrels, is it any wonder that the price of lumber has more than doubled in the last ten years?

It is interesting to know that over 60 million gallons of creosote are used yearly to preserve timber. In addition about 5% of the waste of saw-mills is being used to produce turpentine and wood-alcohol. Another saving is being made by paper mills, which use about 300,000 cords of waste wood annually.

The lesson to be learned from the above statements is that we should appreciate fine lumber, not only for its beauty, but for its actual value. Do you ever waste wood by taking a much larger piece than is required?

In former times logs were hewed or split into lumber, but now they are sawed, either with a band-saw, circular saw, or gang saw. Fig. 24 illustrates the common method of sawing a log into boards, the center of the log being reserved for a timber of square or oblong cross section. Draw a picture of a board sawed in this manner, such as AB, showing which way it will warp, and

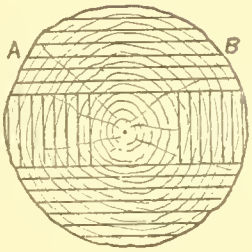


Fig. 24

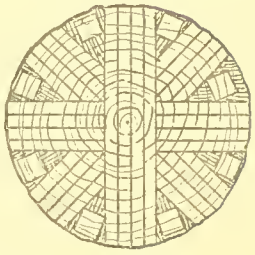


Fig. 25

tell why. Fig. 25 shows a method of making quarter-sawed lumber, which is valuable on account of its beautiful surface, and because it does not warp or twist as much as plain-sawed lumber.

Find out the difference in cost of plain and quarter-sawed (Q. S) lumber.

Trees are classified in many different ways, such as those which grow from the inside as bamboo and palm trees, and those which grow by adding annual layers of wood to the outside.

Among lumbermen, trees are grouped, (1) according to whether they have broad leaves such as oak, maple, ash, and elm; or (2) whether they have needle-like leaves like the pines and cedars. The common name for the first group is hard wood, and for the second, soft wood. Why is this classification misleading?

Make a list of all the different kinds of wood that you know under each group,

Hard Wood. Soft Wood.

Make a list of the woods used in the following trades: Carpenter, Furniture maker, Wagon maker.

What wood is best suited for the following articles and why?

Fence post.
Washing machine.
Mast.
Lead pencil.
Bow.
Aeroplane.
Hammer handle.
Chisel handle.
Ball for bowling alley.

In order to know one kind of wood from another it is necessary to know the qualities that distinguish each variety.

Make a table showing the peculiarity of each of the following woods:

	Grain, close or open	Hardness	Color	Markings[1]
Ash				
Basswood				
Birch				
Gum				
Hickory				
Maple				
Mahogany				
Oak				
Soft pine				
Hard pine				
Sycamore				
Whitewood or Yellow poplar				

[1]By markings is meant those figures such as are seen in quarter-sawed oak. They are produced by those broad cells or fibers which run from the center to the outside.

In some woods they are too fine to be seen, but in others they are very noticeable. This is one of the best ways to detect the difference between ash and oak. Can you tell the difference between the two woods by looking at the end grain? Which does hickory resemble?

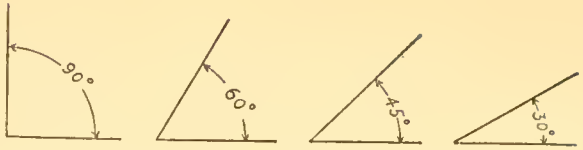
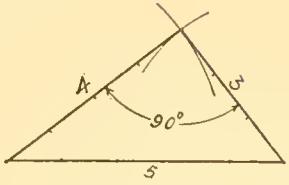
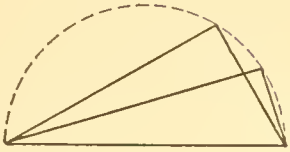


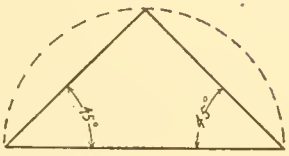
Fig. 26. Angles Commonly Used.



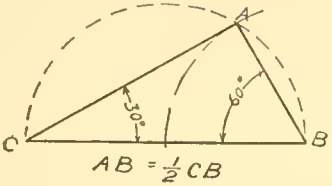
Any triangle whose sides are in the ratio of 3, 4 and 5 is a right-angle triangle.



Any triangle inscribed in a semi-circle is a right-angle triangle.



Any triangle inscribed in a semi-circle, two of whose sides are equal is a 45 degree triangle.



Any triangle inscribed in a semi-circle whose shortest side is one-half the longest side is a 30°-60° triangle.

To draw a hexagon, first draw a circle. With the same radius draw arcs that will divide the circle into six equal parts as shown in Fig. 27.

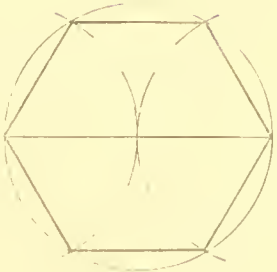


Fig. 27

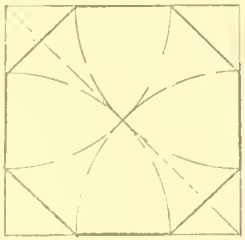


Fig. 28

To draw an octagon, first draw a square; then with a radius equal to half the diagonal of the square, draw arcs which intersect the square as shown in Fig. 28.

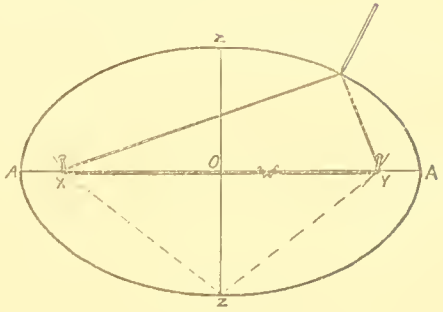


Fig. 29

To draw an ellipse of any given diamters,

1. Lay off the long and short diameters at right angles to each other.

2. Place two pins or nails on the long diameter so that they are as far from the ends of the short diamater z z, Fig. 29, as one-half of the long diameter A A. In other words, make x z and y z=Ao.

3. Make a loop just large enough to reach around the triangle X Y Z. This loop will keep the pencil traveling in a perfect ellipse as shown.

ACCIDENTS

The average boy does not pay much attention to slight wounds, but as sometimes bad cases of infection develop from small beginnings, it is important for every one to know what is the best thing to do in case of accidents.

Before describing the treatment of wounds let it be clearly understood that every chisel or knife, piece of glass or sliver of wood, and even our hands and clean pocket handkerchief, are covered with germs, which if they come in contact with a wound are liable to multiply in great numbers and produce soreness, inflammation and pus.

The rules, then, to follow are:—

1. Never touch a wound with anything that has not been sterilized. This means the killing of all germs either by heat (boiling or alcohol flame) or by disinfectants such as carbolic acid.

2. Sterilize the wound. For this purpose use iodine or boric acid. A certain amount of bleeding is good for a wound as it tends to wash out the pus germs, therefore,

3. Do not bind up a wound too tightly or cover it with court plaster, shellac, or anything that will seal it up tight. Why?

Running water is good to wash out particles of dirt. Gentle bleeding may be stopped with a bandage of sterilized cotton or gauze wound only tight enough to hold it in place.

4. In case of a severe hemorrhage try to stop the supply of blood by putting a finger or tight bandage on the artery between the wound and the heart. If possible keep the wounded part elevated. If the bleeding does not stop soon send for a doctor or surgeon.

5. In case of dizziness or fainting, first admit plenty of fresh air; second, lay the patient down with the feet raised so that more blood can go to the head.

6. Splinters should be removed as soon as possible. Never use a brass pin in doing this, but rather a needle or knife blade which has been sterilized in a flame or boiling water.

When a splinter breaks off under a finger nail, scrape away a small portion of the nail so that the splinter may be removed.

7. In case of sprains hold the injured part in hot water for about thirty minutes; then bandage snugly.

8. If you get particles in the eye, do not rub the eye, but have someone examine it, and if the particle is visible, have it removed with a soft cloth or wad of cotton wrapped on the end

of a small stick. A piece of soft paper folded to a sharp point will also serve.

Important: Every shop should have a "First Aid" cabinet which should contain

Rolls of bandages,
Antiseptic cotton and gauze,
Tincture of iodine, or
Boric acid in dry form,
Tweezers.

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